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CONODONTS FROM THE DEVONIAN LINGLE AND ALTO FORMATIONS OF SOUTHERN ILLINOIS

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ABSTRACT

Twenty-seven species of conodonts were collected from the type sections of the Lingle and Alto Formations in Union County, Illinois. The species represent the genera Acodina, Angulodus, Belodus, Bryantodus, Falcodus?, Hindeodella, Icriodus, Ligonodina, Lonchodina, Neoprioniodus, Ozarkodina, Paltodus, Polygnathus, Roundya, and Synprioniodina and show the faunas of the two formations to be separate and distinct.

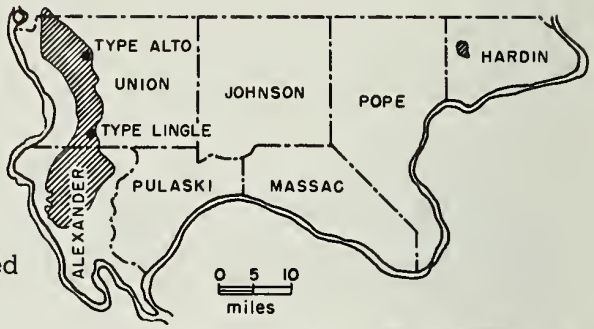
The most important species in the Lingle Formation are Icriodus latericrescens and Polygnathus liquiformis. Neither occur in the Alto Formation. The occurrence of I. latericrescens is recognized as the upper of several separate stratigraphic intervals known for the species and correlates with similar occurrences in the Givetian of Germany and the Hamilton of New York. The Lingle is thus assigned to late but not latest Middle Devonian time.

The presence of Polygnathus cristata and P. decorosa in significant numbers in the Alto indicates that it correlates with a conodont zone between the Middle Devonian Givetian and the Upper Devonian Frasnian in Germany. Because the Alto correlates with post-Tully strata in New York, it is placed in the Upper Devonian.

INTRODUCTION

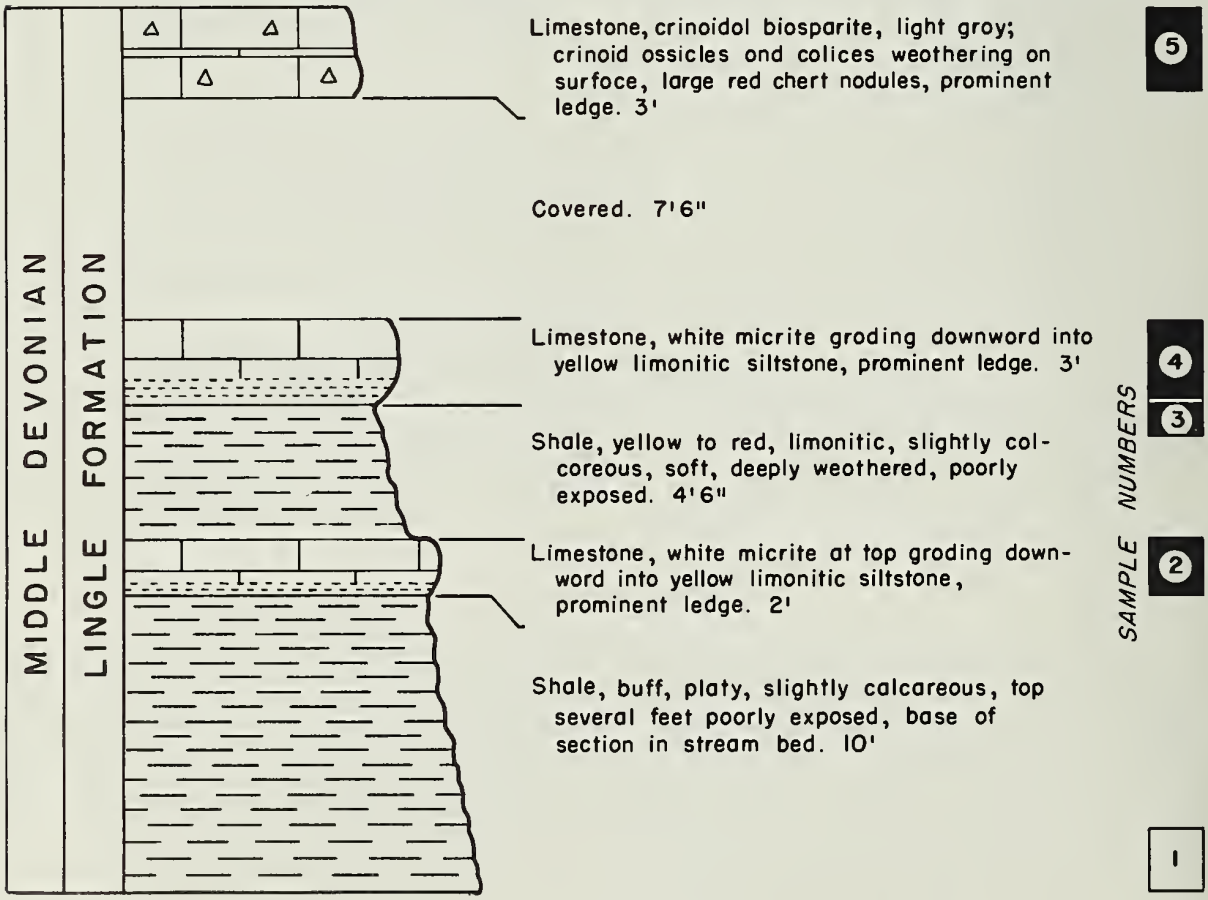
The Lingle Limestone was named by Savage in 1920 for limestone cropping out on Lingle Creek in Union County, Illinois (Text-figure 1). In its original usage, the formation occupied the interval between the Misenheimer Shale and the Alto Formation; the name Misenheimer was applied to argillaceous beds underlying characteristic Lingle Limestone. Weller (1944a, p. 96) disagreed with Savage's usage and noted that "Other similar shaly beds, however, occur abundantly at higher horizons, and no such formation as the Misenheimer can be consistently recognized." He consequently included strata originally called Misenheimer in the Lingle Formation, and today all

beds between the Grand Tower and Alto Formations are referred to the Lingle. The type section of the latter is located in the northeast bank of a tributary to Lingle Creek, immediately east of the gravel road in SE¼ SW¼ SW¼ sec. 26, T. 13 S., R. 2 W., Union County, Illinois; Jonesboro Quadrangle. The detailed section showing sampled intervals is presented in Text-figure 2.



Text-fig. 1–Locations of the type sections of the Lingle and Alto Formations in the Devonian outcrop area in southwestern Illinois.

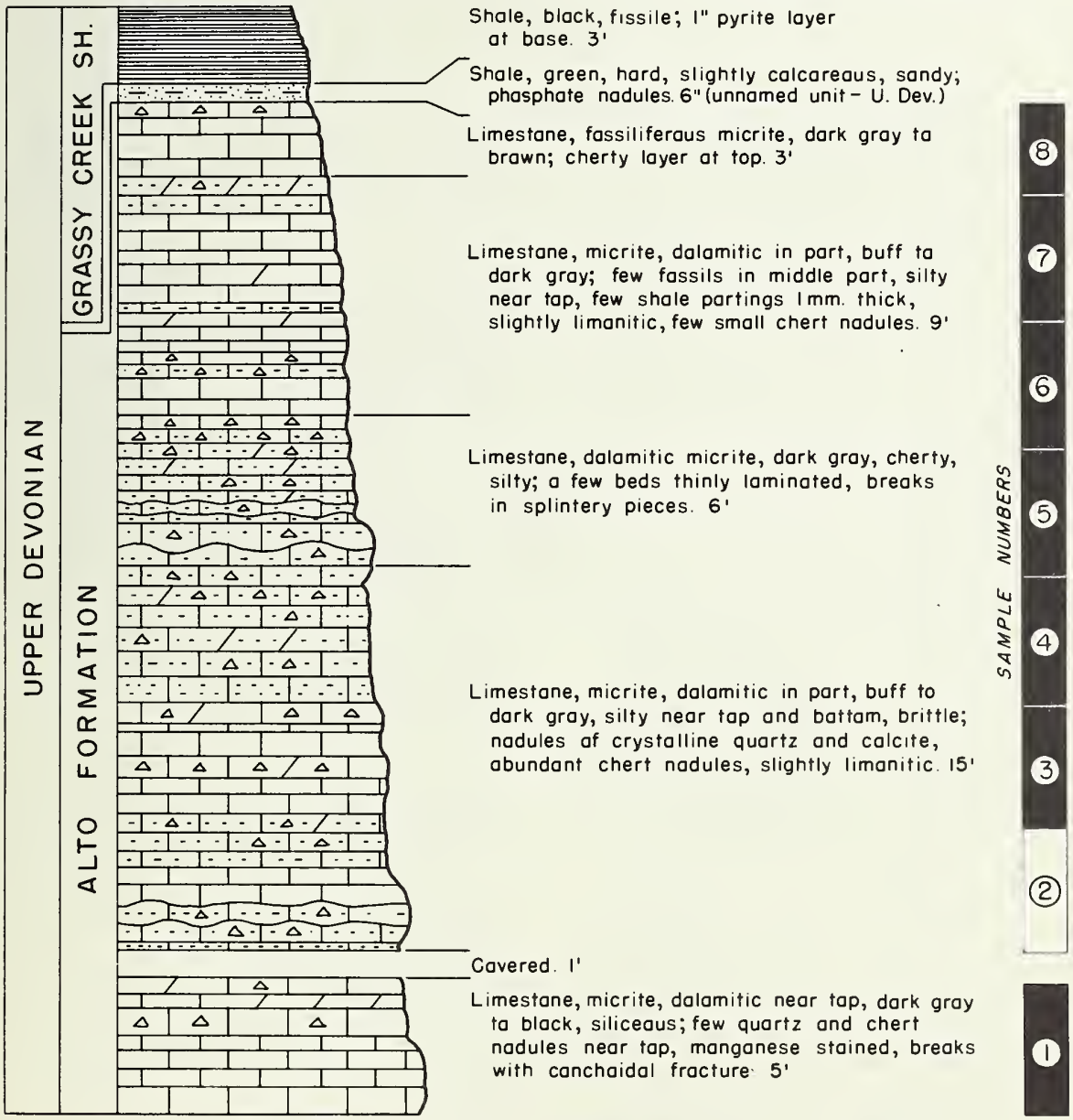
The Alto Formation was named by Savage in 1920 for dark, siliceous shale and shaly limestone cropping out along a creek in the NE¼ sec. 34, Alto Township, Union County, Illinois. He stated that at the locality "a hard, black, laminated shale having a band of iron pyrites in the basal part..., unconformably overlies the Alto Formation." To this unit, Savage applied the name Mountain Glen Shale. In 1956, Workman & Gillette rejected the name Mountain Glen in favor of the older name New Albany on the bases of similar lithology, stratigraphic relationships, and mutual continuity. Collinson & Scott (1958) referred this black shale to the Grassy Creek, rather than to the New Albany, because it includes no



Text-fig. 2–Type Lingle. In north bank of a tributary to Lingle Creek, about 2.7 miles SW of Springville, immediately east of gravel road, SE¼ SW¼ SW¼ sec. 26, T. 13 S., R. 2 W., Union County, Illinois; Jonesboro Quadrangle. Black areas indicate conodont-yielding samples.

equivalents of the upper part of the New Albany but instead represents the same age and stratigraphic interval as the Grassy Creek and is continuous with the latter. The type section of the Alto Formation, from which the samples for this study were taken, is on the south bank of Clear Creek in the center of the N½ NE¼ NE¼ sec. 34, T. 11S., R. 2 W., Union County, Illinois; Alto Pass Quadrangle. The detailed section showing sampled intervals is presented in Text-figure 3.

The purpose here is to describe the conodonts of the Lingle and Alto in order to determine the stratigraphic positions of the formations within the Devonian System. There has existed considerable uncertainty regarding placement of the Alto in either the Middle or Upper Devonian. Savage (1920), Weller (1940, 1944a), Cooper et al. (1942), Cooper (1944), and Collinson & Scott (1958) placed the Alto in the Upper Devonian. Weller (1944b) and Workman & Gillette (1956) considered it to be Middle



Text-fig. 3–Type Alto. Along south bank of Clear Creek, about 1.3 miles SW of Mountain Glen, C N½ NE¼ NE¼ sec. 34, T. 11 S., R. 2 W., Union County, Illinois; Alto Pass Quadrangle. Black areas indicate conodont-yielding samples.

Devonian. It is shown here that comparison of Lingle and Alto conodont faunas with those of Devonian sections in Germany and New York establishes the age of the Lingle as late Middle Devonian and the Alto as early Upper Devonian.

Acknowledgements

This project was undertaken under the direction of Charles Collinson. D. H. Swann contributed much to the stratigraphic aspects of the study. Gilbert Klapper gave information about faunas from New York as well as valuable advice concerning taxonomy. H. B. Willman critically read the manuscript.

GENERAL ASPECTS OF THE FAUNA

The conodont collections from the type sections of both the Lingle and Alto contain approximately 350 specimens. These represent 27 species that are referable to the following 15 genera: Acodina, Angulodus, Belodus, Bryantodus, Falcodus?, Hindeodella, Icriodus, Ligonodina, Lonchodina, Neoprioniodus, Ozarkodina, Paltodus, Polygnathus, Roundya, and Synprioniodina.

Conodonts in the Lingle Formation represent two distinctive faunas (table 1). The lower, found in the shales, siltstones, and micrite limestones, is dominated by Polygnathus linguiformis, which represents more than 50 per cent of the specimens in some samples. The upper fauna is found in the crinoidal biosparite limestone and consists almost entirely of representatives of Icriodus latericrescens. Neither P. linguiformis nor I. latericrescens occur in the Alto. I. symmetricus is of common occurrence in the Lingle, and Paltodus sp., I. alternatus, and Acodina curvata are represented by only a few individuals.

More than 24 species have been collected from the Alto Formation. Most abundant is Polygnathus decorosa, which is followed in numbers of P. cristata. Of common occurrence and listed in order of decreasing abundance are: Falcodus? sp., Icriodus symmetricus, and Polygnathus n. sp. Uncommon species are: Polygnathus pennata, Angulodus walrathi, Bryantodus huddlei n. name, Neoprioniodus armata, Icriodus alternatus, and Polygnathus cf. P. peracuta. In addition Acodina curvata, Belodus sp., Hindeodella austinensis, Ligonodina monodenta, Polygnathus sp., Polygnathus? sp., and Synprioniodina sp. are represented by only a few specimens and are of little stratigraphic significance.

The composition of the fauna of the Alto Formation is nearly uniform throughout, although there is a difference in abundance of specimens between upper and lower parts of the unit. Of the eight intervals sampled (table 2), specimens are relatively common in the upper four, but in marked contrast, they are rare in three of the lower intervals and absent in the remaining one.

TABLE 1 – STRATIGRAPHIC DISTRIBUTION OF CONODONT SPECIES IN THE TYPE SECTION OF THE LINGLE FORMATION

	Sample					
Conodont Species	(top)	5	4	3	2	1
Acodina curvata			X			
Bryantodus spp.			X			
Hindeodella spp.			X	X	X	
Icriodus alternatus			X			
I. latericrescens		X				
I. symmetricus			X		X	
Paltodus sp.		X	X			
Polygnathus linguiformis			X	X	X	

CORRELATIONS

The fauna of the Lingle Formation is characterized by the distinctive platform species, Polygnathus linquiformis and Icriodus latericrescens. Several morphologic varieties of the latter occur in separate stratigraphic intervals within the Devonian System. At the Sellersburg Stone Company Quarry at Sellersburg, Indiana, two intervals are present. The lower is in the Jeffersonville Limestone; the upper is in the North Vernon Limestone. Separate stratigraphic intervals of varieties of I. latericrescen are also known in Germany. Bischoff & Ziegler (1957) reported I. latericrescens from the Lower Devonian (Emsian) Princeps-Kalk and Schönauer Kalk. Wittekindt (1961) identified the species from the Middle Devonian (Givetian) Polygnathus varca Zone. G. Klapper (personal communication) has reported Icriodus latericrescens in New York from the Middle Devonian Tichenor Member of the Ludlowville Formation, the Menteth and Kashong Members of the Moscow Formation, all of the Hamilton Group, and from the overlying Tully Limestone. The general faunal aspect of the Lingle is similar to those of the Tichenor and Menteth. The Lingle is equivalent to part of the Hamilton Group, and is almost certainly correlative with the Polygnathus varca Zone of Ziegler (1962), despite the fact that P. varca was not recognized in the collections.

The fauna of the Alto Formation is characterized by Polygnathus cristata and P. decorosa. In Germany, P. cristata is restricted to the P. ordinata–P. dubia and P. dubia–Ancyrodella rotundiloba Subzones of Bischoff & Ziegler (1957). The latter subzone is characterized by the namebearers, Polygnathus dubia asymmetrica and Ancyrodella rotundiloba, neither of which have been found in the Alto. Klapper (personal communication) in a preliminary sampling of limestone units from the base of the Onondaga to the top of the Tully in New York, did not obtain P. cristata from any of the sampled units. This indicates that the Alto is post-Tully, and it probably is correlative with the P. ordinata–P. dubia Subzone which is represented in transitional beds between the Middle Devonian Givetian and the Upper Devonian Frasnian in Germany (Ziegler, 1958). Because the Alto Formation is younger than the Tully Limestone of New York, it is placed on the Upper Devonian, and it is the oldest Upper Devonian unit in southern Illinois.

TABLE 2 – STRATIGRAPHIC DISTRIBUTION OF CONODONT SPECIES IN THE TYPE SECTION OF THE ALTO FORMATION

	Sample							
Conodont Species	(top) 8	7	6	5	4	3	2	1
Acodina curvata	X							
Angulodus walrathi		X						
Belodus sp.	X							
Bryantodus huddlei n. name		X		X				
B. spp.	X	X	X	X		X		
Falcodus? sp.	X	X	X	X				
Hindeodella austinensis		X						
H. spp.	X	X	X	X	X			X
Icriodus alternatus	X	X		X				
I. symmetricus	X	X		X				X
Ligonodina monodentata		X						
L. spp.	X	X	X	X				
Lonchodina spp.	X	X	X	X				
Neoprioniodus armata	X	X		X				
Ozarkodina spp.	X	X	X					
Polygnathus cristata	X	X	X	X				
P. decorosa	X	X	X	X	X	X		X
P. pennata		X						
P. cf. P. peracuta	X		X	X				
P. n. sp.		X	X	X				
P. sp.			X	X				
P.? sp.				X				
Roundya spp.	X	X						
Synprioniodina sp.		X		X				

SYSTEMATIC PALEONTOLOGY

The figured specimens are reposited at the Illinois State Geological Survey under collection number 29P. For detailed information about the stratigraphic distribution of each species see tables 1 and 2.

Genus ACODINA Stauffer, 1940
Type species: Acodina lanceolata Stauffer

ACODINA CURVATA Stauffer
Pl. 1, fig. 11

Acodina curvata STAUFFER, 1940, Jour. Paleontology, v. 14, no. 5, p. 418, pl. 60, figs. 3, 14-16; SANNEMANN, 1955, Senck. leth., Bd. 36, p. 126, pl. 1, fig. 17; ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 98, pl. 7, fig. 25.

Description.—The unit consists of a small, slightly incurving cusp, nearly flat on the outer surface but rounded on the inner. The edges are sharp and slightly extended at the base. A deep conical pit pinches out immediately above the extended base of the cusp.

Material studied.—Two specimens.

Distribution.—Lingle and Alto Formations.

Repository.—Illinois State Geological Survey, 29P2062 (figured specimen).

Genus ANGULODUS Huddle, 1934
Type species: Angulodus demissus Huddle

ANGULODUS WALRATHI (Hibbard)
Pl. 1, fig. 17

Hindeodella walrathi HIBBARD, 1927, Am. Jour. Sci., ser. 5, v. 13, no. 75, p. 205, fig. 4a, b.

Angulodus walrathi (Hibbard) HUDDLE, 1934, Bull. Am. Paleontology, v. 21, no. 72, p. 77, 78, pl. 4, fig. 15, pl. 10, fig. 5; SANNEMANN, 1955, Senck. leth., Bd. 36, p. 127, pl. 3, fig. 16; BISCHOFF, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 121; BISCHOFF & ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 145; BISCHOFF, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 19, p. 17, 19, pl. 5, figs. 44, 45; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 44, pl. 8, figs. 1-6, pl. 20, fig. 7; BUDUROV, 1961, Bulgarian Geol. Soc., Rev., v. 22, pt. 3, p. 260, 261, pl. 3, figs. 5, 10.

Hindeodella catacta HUDDLE, 1934, Bull. Am. Paleontology, v. 21, no. 72, p. 40, pl. 4, fig. 18.

Angulodus elongatus STAUFFER, 1940, Jour. Paleontology, v. 14, no. 5, p. 419, 420, pl. 58, figs. 1, 8, 21, 22.

Hindeodella ampla COOPER (in Cooper & Sloss), 1943, Jour. Paleontology, v. 17, no. 2, p. 173, pl. 28, fig. 30.

Description.—The bar is rather thick, long, slightly compressed, with the anterior part curved laterally and deflected downward in front of the cusp. The anterior part of the bar bears denticles that are round in cross section, subequal in size, inclined posteriorly, and more crowded near the cusp. The cusp is small, about twice the size of the larger denticles and parallel with them. The posterior part of the bar is nearly straight but slightly twisted. It bears a double series of denticles, the larger increasing slightly in size posteriorly and alternating with one to four of the smaller, which are also inclined posteriorly. The underside of the bar is sharp with a small, shallow pit beneath the cusp. A shallow, narrow groove extends for a short distance in both directions from the pit.

Material studied.–Five specimens.
Distribution.–Alto Formation.
Repository.–Illinois State Geological Survey, 29P2031 (figured specimen).

Genus BELODUS Pander, 1856
Type species: Belodus gracilis Pander

BELODUS sp.

Description.–A single, poorly preserved, laterally compressed specimen tapers gradually in a low curve toward the terminal fang. The oral edge is covered throughout most of its length by minute, indistinct, fused denticles. The aboral edge is slightly expanded and gradually diminishes in thickness toward the terminal fang.
Material studied.–A single specimen.
Distribution.–Alto Formation.
Repository.–Illinois State Geological Survey, 29P2040 (unfigured specimen).

Genus BRYANTODUS, Bassler, 1925
Type species: Bruantodus typicus Ulrich & Bassler

BRYANTODUS HUDDLEI Orr, n. name
Pl. 1, figs. 1, 12

[not] Bryantodus flexus BRANSON & MEHL, 1934b, Missouri Univ. Studies, v. 8, no. 4, p. 284, pl. 23, fig. 6.
Bryantodus flexus HUDDLE, 1934, Bull. Am. Paleontology, v. 21, no. 72, p. 70, pl. 2, fig. 12; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 48, pl. 20, fig. 28.

Description.–The unit is arched, laterally bowed, with the posterior end twisted slightly. The cusp is relatively small, laterally compressed, and slightly higher than the adjacent anterior denticles. The denticles are fused, laterally compressed, and tightly packed. Both the anterior and posterior portions bear a similar number of denticles. The anterior bar is slightly longer and bears high denticles subequal in size. The denticles of the posterior bar decrease in height posteriorly. The anteriormost denticles on the unit are nearly vertical. The remainder are inclined posteriorly and are nearly parallel with the cusp. The bar is thin and nearly smooth on its outer side with an inner, rounded, low ridge located approximately midway between the base of the unit and the lower extremities of the denticles. A small, shallow, subcircular pit is located beneath the cusp. The outer edge of the pit projects a short distance outside the bar and may bear a short, low, vertical ridge. A shallow groove extends along the bottom of the bar in both directions from the pit.
Material studied.–Four specimens.
Distribution.–Alto Formation.
Repository.–Illinois State Geological Survey, 29P2006, 29P2057 (figured specimens).

Remarks.–Branson & Mehl applied the name Bryantodus flexus to a species from the Bushberg Sandstone of Missouri in October, 1934. In November of the same year Huddle proposed the name B. flexus for a species from the New Albany Shale of Indiana. The two forms are not conspecific. Thus, B. flexus Huddle is a junior homonym of B. flexus Branson & Mehl. The new name, B. huddlei, is proposed herewith for B. flexus Huddle.

BRYANTODUS spp.
Pl. 1, figs. 9, 10

Remarks.—Several species, largely fragmentary and represented by only a few individuals, are referable to this genus. Two of the more complete speciens are figured.

Material studied.—17 specimens.

Distribution.—Lingle and Alto Formations.

Repository.—Illinois State Geological Survey, 29P2018, 29P2005 (figured specimens).

Genus FALCODUS Huddle, 1934
Type species: Falcodus angulus Huddle

FALCODUS? sp.
Pl. 1, figs. 8, 13, 14

Description.—The unit consists of a highly arched, laterally twisted, denticulate bar. The bar is low, laterally expanded, rounded on the sides, nearly flat on the upper surface, and of varying width. A row of uniformly inclined, fused, narrow denticles, subequal in size, traverses the upper surface of the bar, which is uniform in width on both sides of this median row. A cusp, if distinguishable, is small and generally located above the point of greatest arching. Many specimens do not possess such an apical denticle. A shallow, elongate, basal cavity, varying in size, is located beneath the bar, generally in the area of greatest curvature. The bar thins posteriorly with the posteriormost denticles in some specimens curving around the end of the bar (pl. 3, fig. 13a). The underside of the bar is gently rounded and bears a low keel. A shallow, narrow groove extends a short distance into the keel from both ends of the basal cavity.

Material Studied.—26 specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2029, 29P2015, 29P2038 (figured specimens).

Genus HINDEODELLA Bassler, 1925
Type species: Hindeodella subtilis Ulrich & Bassler

HINDEODELLA AUSTINENSIS Stauffer
Pl. 2, fig. 1

Hindeodella austinensis STAUFFER, 1940, Jour. Paleontology, v. 14, no. 5, p. 424, pl. 58, figs. 3-7, 9; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 58, 59, pl. 7, figs. 8, 11, pl. 20, figs. 34, 35; BUDUROV, 1961, Bulgarian Geol. Soc., Rev., v. 22, pt. 3, p. 262, pl. 3, fig. 6

Description.—The posterior portion of the bar is nearly straight, is slightly compressed laterally, and bears a double series of denticles. The large denticles, subequal in size, parallel, and inclined posteriorly, alternate with one to three small denticles. The cusp is large and nearly parallel with the other denticles. The anterior part of the bar is bent inward, extending sharply downward considerably below the level of the bar, and bears about six tightly packed denticles varying in size. A small, shallow, oval pit is located on the underside of the bar beneath the cusp. A shallow, narrow groove extends from the pit and pinches out in both directions. The underside of the anterior bar is very sharp. The posterior bar possesses a low, moderately sharp keel.

Material studied.–Two specimens.
Distribution.–Alto Formation
Repository.–Illinois State Geological Survey, 29P2036 (figured specimen).

HINDEODELLA spp.

Remarks.–Hindeodellids are not an important constituent of the faunas of the Lingle and Alto Formations but are present in small quantities in both. Due to the fragmentary nature of the material, which consists largely of segments of bars without the cusp, additional specific identifications are not justifiable.
Material studied.–26 specimens.
Distribution.–Lingle and Alto Formations.

Genus ICRIODUS Branson & Mehl, 1938
Type species: Icriodus expansus Branson & Mehl

ICRIODUS ALTERNATUS Branson & Mehl
Pl. 2, figs. 11, 12

Icriodus alternatus BRANSON & MEHL, 1934a, Missouri Univ. Studies, v. 8, no. 3, p. 225, 226, pl. 13, figs. 4-6; BRANSON & MEHL, 1938, Jour. Paleontology, v. 12, no. 2, p. 161, pl. 26, figs. 4-6; GROHSKOPF, CLARK, & ELLISON, 1943, Missouri Geol. Survey & Water Resources 62nd Bienn. Rept., appendix 4, p. 15, pl. 2, figs. 3, 6; MEHL & QUIGLEY, & QUIGLEY respectively (in Branson), 1944, Missouri Univ. Studies, v. 19, no. 3, p. 158, pl. 26, figs. 1-5; BRANSON & MEHL (in Branson), 1944, Missouri Univ. Studies, v. 19, no. 3, p. 163, pl. 28, figs. 11-13, [misprinted as "11, 13"]; YOUNGQUIST & PETERSON, 1947, Jour. Paleontology, v. 21, no. 3, p. 246, pl. 37, figs. 18, 19, 21; DOWNS & YOUNGQUIST, 1950, Jour. Paleontology, v. 24, no. 6, p. 669, pl. 87, figs. 8, 11, 12; HELMS, 1959, Geologie, Jg. 8, H. 6, p. 642, pl. 1, fig. 1a-c, pl. 4, fig. 7; ZIEGLER, 1962, Abh. hess. L.-Amt. Bodenforsch., H. 38, p. 51, 52.
Icriodus elegantulus STAUFFER, 1938, Jour. Paleontology, v. 12, no. 5, p. 430, pl. 52, figs. 26, 27; LYS & SERRE, 1957, Inst. Franç. Pétrole, Rev., v. 12, no. 10, p. 1045, pl. 3, fig. 8a, b.
Icriodus cf. I. alternatus Branson & Mehl LYS & SERRE, 1957, Inst. Franç. Pétrole, Rev., v. 12, no. 10, p. 1045, pl. 3, fig. 5a, b.

Description.–A distinctive feature of this species is the alternation of the median denticles with those of the lateral rows. The denticles of the median row are discrete and in cross section are oval to elongate in a direction parallel to the long axis of the specimen. In some forms, the denticles of the median row are very minute, much smaller than those of the lateral rows. The posteriormost denticle of the median row is commonly inclined posteriorly and generally is the largest denticle on the specimen. Aborally, a groove, traverses the entire length of the specimen. The margins of this basal cavity are nearly straight and taper from their greatest width at the rounded posterior end to a point at the anterior end.
Material studied.–Six specimens.
Distribution.–Lingle and Alto Formations.
Repository.–Illinois State Geological Survey, 29P2000, 29P2049 (figured specimens).

ICRIODUS LATERICRESCENS Branson & Mehl
Pl. 2, figs. 8-10

Icriodus latericrescens BRANSON & MEHL, 1938, Jour. Paleontology, v. 12, no. 2, p. 164, 165, pl. 26, figs. 30-37; STAUFFER (part), 1938, Jour. Paleontology,

v. 12, no. 5, p. 430, pl. 52, figs. 30, 31, 34 [not fig. 32]; GROHSKOPF, CLARK, & ELLISON, 1943, Missouri Geol. Survey & Water Resources 62nd Bienn. Rept., appendix 4, p. 16, pl. 2, figs. 4, 7; YOUNGQUIST, 1947, Jour. Paleontology, v. 21, no. 2, p. 102, 103, pl. 25, fig. 12.

Description.—The platform is long, narrow, slightly bowed, and pointed at the anterior end. The denticles of the lateral rows are large and subcircular in cross section. The denticles of the median row are low, laterally compressed, and tend to fuse into a low, narrow ridge. Three or four of the median denticles extend posteriorly as a fused ridge. The postero-lateral process, consisting of several fused denticles, originates near the posterior end of this ridge. In oral view, this process is nearly perpendicular to the platform at its point of origin and curves slightly posteriorly. Aborally, the unit is excavated deeply throughout its length. Flaring of the sides occurs slightly ahead of the postero-lateral process. From there, the sides of the basal cavity slowly taper to an anterior point. The posterior end of the unit is V-shaped and points inward. The V is formed by the postero-lateral process and a narrow flaring of the basal cavity opposite the process.

Material studied.—Seven specimens.

Distribution.—Lingle Formation.

Repository.—Illinois State Geological Survey, 29P2510, 29P2511, 29P2509 (figured specimens).

Remarks.—As stated under the subhead Correlations, several separate stratigraphic intervals of varieties of Icriodus latericrescens are recognized. The Lingle specimens represent the upper occurrence. Specimens figured by Ziegler (1956) and Bischoff & Sannemann (1958) represent the lower occurrence in the Lower Devonian of Germany. An intermediate interval is known from the Grand Tower Formation of southern Illinois. Specimens from these three intervals are morphologically distinct.

ICRIODUS SYMMETRICUS Branson & Mehl

Pl. 2, figs. 13-15

Icriodus symmetricus BRANSON & MEHL, 1934a, Missouri Univ. Studies, v. 8, no. 3, p. 226, pl. 13, figs. 1-3; BRANSON & MEHL, 1938, Jour. Paleontology, v. 12, no. 2, p. 161, pl. 26, figs. 1-3; BRANSON & MEHL (in Branson), 1944, Missouri Univ. Studies, v. 19, no. 3, p. 163, pl. 28, figs. 1-3; YOUNGQUIST, 1947, Jour. Paleontology, v. 21, no. 2, p. 103, pl. 25, fig 5; BECKMANN, 1949, Senckenbergiana, Bd. 30, p. 155, 161, pl. 1, fig. 6a-c, pl. 3, fig. 1, pl. 4, fig. 5; ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 102, 103, pl. 6, fig. 28; BISCHOFF, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 125; BISCHOFF & ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 148; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 64, pl. 6, figs. 1a-c, 4a, b; MÜLLER & MÜLLER, 1957, Jour. Paleontology, v. 31, no. 6, p. 1106, pl. 138, figs. 1-3, pl. 142, fig. 8; ETHINGTON & FURNISH, 1962, Jour. Paleontology, v. 36, no. 6, p. 1269.

Icriodus sp. HASS, 1951, Am. Assoc. Petroleum Geol. Bull., v. 35, no. 12, p. 2534, pl. 1, fig. 17.

Icriodus symmetricus? Branson & Mehl ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 103, pl. 6, figs. 26, 27.

Icriodus simmetricus [sic] Branson & Mehl BUDUROV, 1961, Bulgarian Geol. Soc., Rev., v. 22, pt. 3, p. 263, pl. 2, figs. 11a-c, 12a, b.

Description.—The platform is elongate, straight to slightly bowed, with the greatest width at the posterior end. The denticles in the median row are connected generally by a shallow longitudinal ridge. As the form matures, the denticles in the median row tend to fuse, particularly in the posterior third. The denticles of the median row are circular to longitudinally elongate in cross section. Those of the

lateral rows are circular to elongate and taper toward the median row. The denticles in the lateral rows are either aligned with, or slightly posterior to, the denticles of the median row. An extension is present at the posterior end and consists of two to four denticles of the median row. Commonly, denticles of this extension are laterally compressed with the posteriormost being the largest on the specimen. The sides of the platform are subparallel and taper toward the pointed anterior end. Aborally, the species is deeply excavated throughout its length. The greatest width of the basal cavity is found posteriorly where the sides are widely flared. The flared portion is subcircular in outline and nearly twice as wide as the above oral surface; it occupies one-half to one-third the length of the specimen. From the flared portion, the sides of the basal cavity narrow considerably and taper gradually to an anterior point.

Material studied.–32 specimens.

Distribution.–Lingle and Alto Formations.

Repository.–Illinois State Geological Survey, 29P2506, 29P2500, 29P2012 (figured specimens).

Remarks.–The lateral denticles of the specimens of the Alto Formation are more transversely elongate than those of the Lingle Formation. The species exhibits a broad range of variability and differs significantly in appearance from juveniles to the most mature specimens. Features that vary considerably within the species are length of median extension, number of denticles, shape of denticles (particularly of the lateral), length of flared portion, and shape of flared area of the basal cavity. Features that generally are constant are the oral outline of the platform, the place of greatest width of the platform, and connection of the median denticles by a low longitudinal ridge.

Genus LIGONODINA Bassler, 1925
Type species: Ligonodina pectinata Ulrich & Bassler

LIGONODINA MONODENTATA Bischoff & Ziegler
Pl. 1, fig. 15

Ligonodina monodentata BISCHOFF & ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 148, 149, pl. 14, fig. 13; BISCHOFF, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 19, p. 31, pl. 5, fig. 6; HELMS, 1959, Geologie, Jg. 8, H. 6, p. 642, 643, pl. 2, fig. 1.

Description.–The posterior bar is very long, nearly straight, and medially grooved aborally. The groove is expanded slightly and deepens beneath the anterior fang which is nearly perpendicular to the bar. The large denticles are spaced evenly, subequal in size, and inclined posteriorly. Large denticles on the figured specimen are paired; the middle pair is the largest. The antero-lateral process is extremely short and consists of a single denticle adjacent to the anterior fang.

Material studied.–A single specimen.

Distribution.–Alto Formation.

Repository.–Illinois State Geological Survey, 29P2004 (figured specimen).

Remarks.–The figured specimen differs from the holotype in that it is less arched beneath the anterior fang and possesses a smaller antero-lateral denticle.

LIGONODINA spp.

Remarks.–A number of fragmentary specimens that are referable to Ligonodina occur in the Alto Formation. Specific identifications are unjustifiable.

Material studied.–Nine specimens.

Distribution.–Alto Formation.

Genus LONCHODINA Bassler, 1925
Type species: Lonchodina typicalis Ulrich & Bassler

LONCHODINA spp.
pl. 2, fig. 3

Remarks.–A number of fragmentary specimens are referable to this genus but they constitute a minor element of the fauna. The figured specimen is characteristic of the kind of material available.

Material studied.–Ten specimens.

Distribution.–Alto Formation.

Repository.–Illinois State Geological Survey, 29P2056 (figured specimen).

Genus NEOPRIONIODUS Rhodes & Müller, 1956
Type species: Prioniodus conjunctus Gunnell

NEOPRIONIODUS ARMATA (Hinde)
Pl. 2, fig. 5

Prioniodus armatus HINDE, 1879, Quart. Jour. Geol. Soc. London, v. 35, p. 360, pl. 15, figs. 20, 21; GRABAU, 1899, Buffalo Soc. Nat. Sci., Bull., v. 6, pt. 2, p. 152, fig. 33F; BRYANT, 1921, Buffalo Soc. Nat. Sci., Bull., v. 13, no. 2, p. 18, 19; ULRICH & BASSLER, 1926, U. S. Natl. Mus. Proc., v. 68, art. 12, p. 12; HOLMES, 1928, U. S. Natl. Mus. Proc., v. 72, art. 5, p. 20, pl. 3, figs. 9, 10.

Prioniodina armata (Hinde) SANNEMANN, 1955, Senck. leth., Bd. 36, p. 151, pl. 3, figs. 2, 3 [contains extensive synonomy list]; BISCHOFF, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 135, pl. 10, figs. 15-17; BISCHOFF & ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 160; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 105, pl. 9, figs. 4a, b, 6a, b, 9.

Neoprioniodus armatus (Hinde) HELMS, 1959, Geologie, Jg. 8, H. 6, p. 644, pl. 4, fig. 18; ETHINGTON & FURNISH, 1962, Jour. Paleontology, v. 36, no. 6, p. 1274, 1275.

Neoprioniodus armata (Hinde) SCOTT & COLLINSON, 1961, Kansas Geol. Soc., Guidebook, 26th Ann. Field Conf., p. 127, pl. 2, figs. 22, 24, [also published in the Missouri Geol. Survey & Water Resources Rept. Inv. 27].

Description.–The posterior bar is compressed slightly and bears high, discrete denticles, that are subequal in size and parallel to the large, incurving terminal fang. The base of the latter extends below the level of the bar as a short, nondenticulate process. A large basal cavity, flaring markedly inward, is located beneath the terminal fang and the anterior process. It continues beneath the posterior bar as a broad, shallow grove.

Material studied.–Four specimens.

Distribution.–Alto Formation.

Repository.–Illinois State Geological Survey, 29P2016 (figured specimen).

Genus OZARKODINA Branson & Mehl, 1933
Type species: Ozarkodina typica Branson & Mehl

OZARKODINA spp.
Pl. 1, figs. 2, 16

Remarks.–Ozarkodinids constitute a minor element of the fauna of the Alto Formation. Specimens are largely incomplete and appear to represent several species. The figured specimens indicate the nature of the material.

Material studied.–12 specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2051, 29P2020 (figured specimens).

Genus PALTODUS Pander, 1856
Type species: Paltodus subaequalis Pander

PALTODUS sp.
Pl. 2, figs. 4, 7

Description.—The unit consists of a strongly curved cusp that tapers gradually to a point. The apical one-third curves strongly inward in such a manner as to be nearly parallel with the base. The lower edge is low and sharp; the upper edge is somewhat higher and serrated in its lower extent. The base, which is excavated very deeply, extends for more than two-thirds the length of the specimen. In cross section one side is slightly convex, and the other is very strongly convex.

Material studied.—Two specimens.

Distribution.—Lingle Formation.

Repository.—Illinois State Geological Survey, 29P2503, 29P2508 (figured specimens).

Genus POLYGNATHUS Hinde, 1879
Type species: Polygnathus dubius Hinde

POLYGNATHUS CRISTATA Hinde
Pl. 3, figs. 4-8, 10; text-fig. 4A-K

Polygnathus cristatus HINDE, 1879, Quart. Jour. Geol. Soc. London, v. 35, p. 366, pl. 17, fig. 11; GRABAU, 1899, Buffalo Soc. Nat. Sci., Bull., v. 6, pt. 2, p. 156, fig. 41; BRYANT, 1921, Buffalo Soc. Nat. Sci., Bull., v. 13, no. 2, p. 24; HOLMES, 1928, U. S. Natl. Mus. Proc., v. 72, art. 5, p. 17, pl. 7, fig. 7.
Polygnathus cristata Hinde BRANSON & MEHL, 1933b, Missouri Univ. Studies, v. 8, no. 2, p. 147, pl. 11, fig. 10; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 86, 87, pl. 15, figs. 1a-13b, 16, pl. 17, figs. 12, 13.

Description.—The platform is oval in outline with a pointed posterior end. In lateral view, it is arched. The oral surface is covered with strong, round nodes, randomly distributed. On juveniles, the nodes are few and widely separated; on more mature specimens, the nodes are numerous (50 or more) and densely spaced. In the area of the platform, the blade consists of 6 to 14 strong, round, discrete nodes. The free blade is short, extending one-third to one-half the length of the platform. Its anterior end is arched downward; the anterior margin may be either smooth or serrated. Orally, the free blade consists of 6 to 8 large, fused denticles that are oval in cross section and increase in height anteriorly. In a number of mature specimens, the free blade has been broken near the anterior end of the platform and slightly offset laterally from the continuing median row of nodes. This condition has not been observed in juveniles. A small, oval basal cavity, around which concentric growth rings are developed, is located in the middle part of the aboral side of the platform. A distinct, low keel traces the course of the blade.

Material studied.—40 specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2001-29P2003, 29P2011, 29P2013, 29P2026 (figured specimens).

Remarks.—This species and Polygnathus decorosa are the most abundant forms in the Alto Formation at its type section.

No specimens were observed such as those figured by Bischoff & Ziegler (1957) in which the nodes were fused into a system of branching ridges. These ridges appear to be a condition of a late growth stage not found in Alto specimens.

Text-figure 4 shows the relationship of number and arrangement of nodes on the platform to the ontogenetic stage of 11 specimens of Polygnathus cristata from the Alto Formation.

POLYGNATHUS DECOROSA Stauffer

Pl. 1, figs. 3-5, 7; pl. 3, fig. 2

Polygnathus decorosus STAUFFER, 1938, Jour. Paleontology, v. 12, no. 5, p. 438, pl. 53, figs. 1, 5, 6, 10, 11, 15, 16, 20, 30.

Polygnathus decorosa Stauffer YOUNGQUIST, 1947, Jour. Paleontology, v. 21, no. 2, p. 109, pl. 24, fig. 21; YOUNGQUIST & PETERSON, 1947, Jour. Paleontology, v. 21, no. 3, p. 250, pl. 36, figs. 10-12; MILLER & YOUNGQUIST, 1947, Jour. Paleontology, v. 21, no. 6, p. 514, 515, pl. 74, figs. 6, 7; DOWNS & YOUNGQUIST, 1950, Jour. Paleontology, v. 24, no. 6, p. 670, pl. 87, figs. 3, 4, 23-26; BISCHOFF, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 84, p. 132, pl. 9, figs. 15-17, 20, 23; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 87; BISCHOFF & SANNEMANN, 1958, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 86, p. 102; ETHINGTON & FURNISH, 1962, Jour. Paleontology, v. 36, no. 6, p. 1281, 1282.

Polygnathus aff. P. decorosus Stauffer LYS & SERRE, 1957, Inst. Franç. Pétrole, Rev., v. 12, no. 10, p. 1048, pl. 5, fig. 3.

Polygnathus foliata Bryant MÜLLER & MÜLLER, 1957, Jour. Paleontology, v. 31, no. 6, p. 1086, 1087, pl. 135, fig. 1a, b.

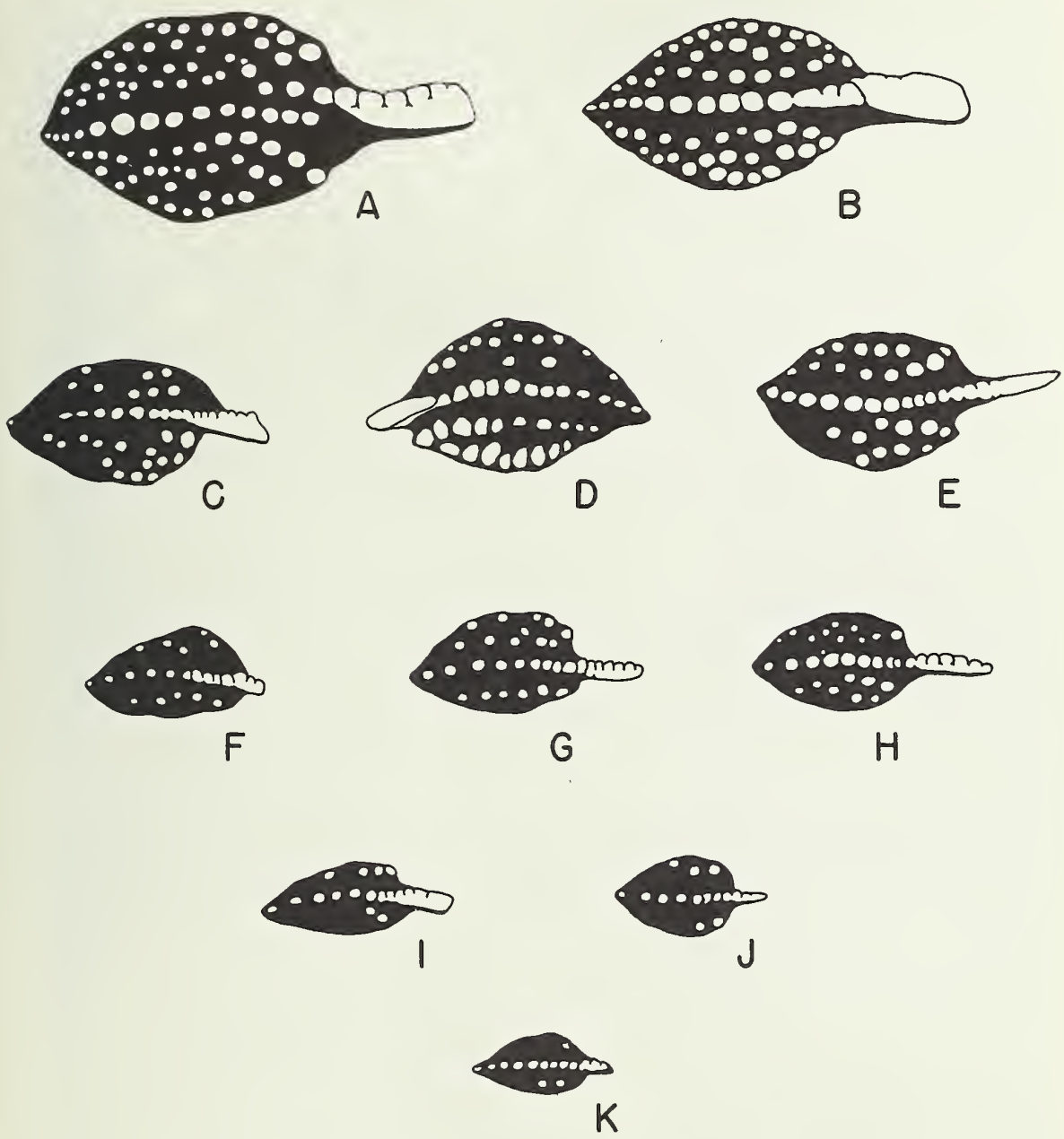
Polygnathus cf. P. decorosus Stauffer PANSERI & BARSOTTI, 1959, Inst. Geol. Min. España, Notas y Com., no. 55, p. 162, 163, pl. 1, fig. 9.

Description.—The platform is narrow, lancet-shaped in outline, pointed at the posterior end, and slightly arched in lateral view. The oral surface is troughlike. In mature specimens, the edges are covered with transverse ribs or elongate nodes. In juvenile specimens, the edges are smooth to indistinctly nodose. The most posterior part of the platform, which is bent down, subsides into a slightly concave curve anteriorly and joins in the middle with the free blade. From this point an indistinct ledge, sometimes lacking in juveniles, extends along both sides of the free blade. The latter is nearly equal in length to the platform and consists of 10 to 14 denticles, which are oval in cross section, partly fused, and increase in height anteriorly. The blade is nearly straight to slightly bowed in the vicinity of the platform. Its anterior end is smooth and straight. The blade continues, as a row of fused nodes, to the posterior end of the platform. In juveniles, a well-defined, round basal cavity is found on the aboral side at the anterior end of the platform. It is located slightly anterior to the platform and possesses flared edges. From the basal cavity, a strong, sharp keel projects to the posterior end of the platform. A groove extends from the opposite side of the basal cavity to a point midway on the free blade.

Material studied.—125 specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2008, 29P2009, 29P2019, 29P2024, 29P2025, 29P2042 (figured specimens).



Text-fig. 4—Oral views of 11 specimens of Polygnathus cristata from the Alto Formation illustrating the relationship of number and arrangement of nodes on the platform to ontogenetic stage:

A, specimen (29P2013)
B, specimen (29P2011)
C, specimen (29P2065)
D, specimen (29P2066)
E, specimen (29P2003)
F, specimen (29P2067)
G, specimen (29P2001)
H, specimen (29P2002)
I, specimen (29P2068)
J, specimen (29P2069)
K, specimen (29P2026)

All X50.

Remarks.–This is the most abundant species in the Alto Formation at its type section.

Müller & Müller (1957) considered Polygnathus decorosa a junior synonym of P. foliata Bryant. However, the latter is characterized by nodes and the former by transverse ridges. Apparently the specimens of Müller & Müller were transitional between the two, exhibiting both nodes and ridges. As has been noted in the preceding description, juvenile specimens of P. decorosa do not show distinct ridges and may indeed be smooth. However, in adult specimens transverse ridges are well developed. The author, therefore, interprets P. decorosa and P. foliata as distinct species.

POLYGNATHUS LINGUIFORMIS Hinde

Pl. 4, figs. 8, 9

Polygnathus linguiformis HINDE, 1879, Quart. Jour.Geol. Soc. London, v. 35, p. 367, pl. 17, fig. 15; GRABAU, 1899, Buffalo Soc. Nat. Sci., Bull., v. 6, pl. 2, p. 157, fig. 44; BRYANT, 1921, Buffalo Soc. Nat. Sci., Bull., v. 13, no. 2, p. 25, pl. 11, figs. 1-9, pl. 14, fig. 2; HOLMES, 1928, U. S. Natl. Mus. Proc., v. 72, art. 5, p. 18, pl. 7, fig. 22; HUDDLE, 1934, Bull. Am. Paleontology, v. 21, no. 72, p. 95, 96, pl. 8, figs. 4, 5; ZIEGLER, 1956, Notizbl. hess. L.-Amt. Bodenforsch., Bd., 84, p. 103, 104, pl. 7, figs. 11, 12, 15-20; STEWART & SWEET, 1956, Jour. Paleontology, v. 30, no. 2, p. 270, 271, pl. 34, figs. 9, 11; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 92, 93, pl. 1, figs. 1-13, pl. 16, figs. 30-35, pl. 17, figs. 1-8; CLOUD, BARNES, & HASS, 1957, Geol. Soc. Am. Bull., v. 68, no. 7, p. 812, pl. 4, fig. 1; RHODES & DINELEY, 1957, Jour. Paleontology, v. 31, no. 2, p. 365, 366, pl. 37, figs. 17-19, 21, pl. 38, fig. 3; BISCHOFF & SANNEMANN, 1958, Notizbl. hess. L.-Amt. Bodenforsch., Bd. 86, p. 102; BUDUROV, 1961, Bulgarian Geol. Soc., Rev., v. 22, pt. 3, p. 264, pl. 1, figs. 5a, b, 7a-10b, 12; REICHSTEIN, 1962, Geologie, Jq. 11, Nr. 39, pl. 1, figs. 17, 18.

Polygnathus? simplex HINDE, 1879, Quart. Jour. Geol. Soc. London, v. 35, p. 367, pl. 17, fig. 18; GRABAU, 1899, Buffalo Soc. Nat Sci., Bull., v. 6, pt. 2, p. 157, fig. 46.

Polygnathus simplex Hinde HOLMES, 1928, U. S. Natl. Mus. Proc., v. 72, art. 5, p. 19, pl. 7, fig. 5.

EXPLANATION OF PLATE 1

All figures X60

FIGS.	Numbers in parentheses refer to specimen number.
1 12	Bryantodus huddlei Orr, n. name. Outer lateral views (29P2006, 29P2057).
2, 16	Ozarkodina spp. Outer lateral and inner lateral views, respectively, of incomplete specimens (29P2051, 29P2020).
3-5, 7	Polygnathus decorosa Stauffer. 3, Oral view (29P2024); 4a-c, inner lateral, oral, and aboral views, respectively (29P2008); 5a, b, aboral and oral views, respectively, of juvenile (29P2042); 7a, b, inner lateral and oral views, respectively, of juvenile (29P2025).
6	Polygnathus pennata Hinde. 6a, b, Oral and aboral views, respectively (29P2019).
8, 13, 14	Falcodus? sp. 8, Outer lateral view of incomplete specimen (29P2029); 13a, b, outer lateral and aboral views, respectively, of incomplete specimen (29P2015); 14, inner lateral view of incomplete specimen (29P2038).
9, 10	Bryantodus spp. Outer lateral views (29P2018, 29P2005).
11	Acodina curvata Stauffer. Inner lateral view (29P2062).
15	Ligonodina monodentata Bischoff and Ziegler. Inner lateral view (29P2004).
17	Angulodus walrathi (Hibbard). Inner lateral view (29P2031).

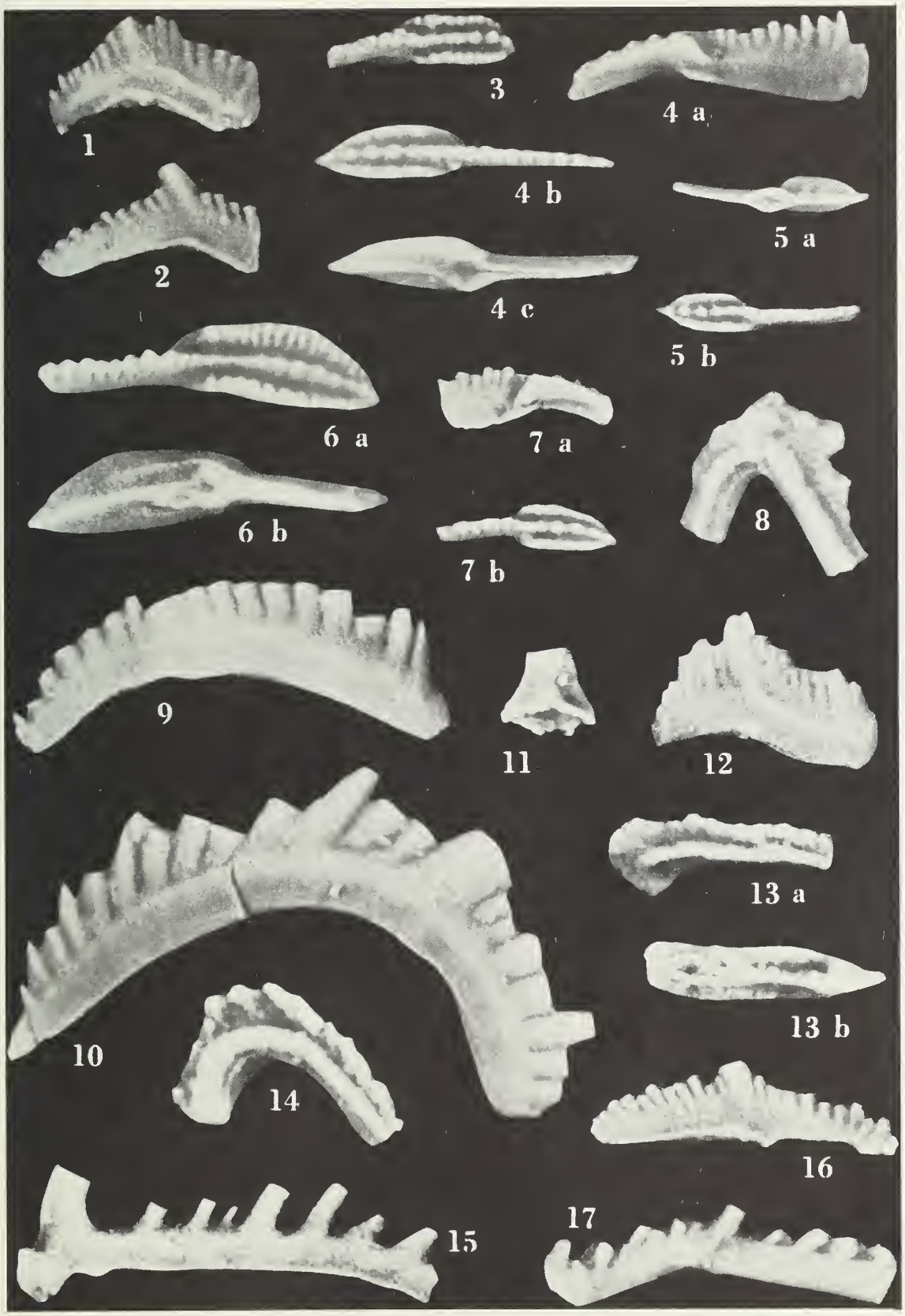


PLATE 1 ORR

Polygnathus sanduskiensis STAUFFER, 1938, Jour. Paleontology, v. 12, no. 5, p. 438, pl. 53, figs. 27, 36, 37; STAUFFER, 1940, Jour. Paleontology, v. 14, no. 5, p. 430, pl. 60, figs. 80, 82, 89, 90.

Description.–The platform is trough-shaped and asymmetrical. It begins narrowest anteriorly and broadens posteriorly to its greatest width at the point of flexure where it is bent downward and inward. The downcurved portion continues to either a rounded or a pointed end. The outer edge of the platform is considerably bowed; the inner edge is uniformly bent. Ribs, developed on the outer edge, are strongest at the rim and disappear approximately halfway to the inner trough, which is unornamented. The inner edge of the platform bears nodes that are distributed randomly. The deflected posterior part of the platform bears a number of transverse ridges that extend from the outer to the inner edge. In some specimens, these ridges may be very indistinct or even absent. In others, the deflected portion bears randomly distributed nodes on the inner side; the outer side is nearly smooth with traces of weakly developed ridges. The free blade is much shorter than the platform and is composed of fused, laterally compressed denticles, which are oval in cross section and attain their greatest height at the anterior end. It continues across the platform as a row of fused denticles or nodes to the point of flexure. The aboral surface of the platform is nearly smooth with concentric growth lines. In the anterior half of the platform is an elongate, moderately deep, basal cavity with weak edges from which a sharp keel extends to the posterior end of the platform. A narrow, distinct groove extends anteriorly from the basal cavity on the lower edge of the blade.

Material studied.–33 specimens.

Distribution.–Lingle Formation.

Repository.–Illinois State Geological Survey, 29P2502, 29P2505 (figured specimens).

Remarks.–This is the most abundant species in the Lingle Formation at its type section. In some samples, it comprises greater than fifty percent of the total number of specimens.

POLYGNATHUS PENNATA Hinde

Pl. 1, fig. 6; pl. 4, figs; 5, 6

Polygnathus pennatus HINDE, 1879, Quart. Jour. Geol. Soc. London, v. 35, p. 366, pl. 17, fig. 8; CLARKE, 1887, Sixth Ann. Rept. State Geologist New York, pl. A-1, fig. 9; GRABAU, 1899, Buffalo Soc. Nat. Sci., Bull., v. 6, pt. 2, p. 156, fig. 39;

EXPLANATION OF PLATE 2

All figures X60

Numbers in parentheses refer to specimen number.

FIGS.	
1	Hindeodella austinensis Stauffer. Inner lateral view (29P2036).
2	Roundya sp. Posterior view (29P2037).
3	Lonchodina sp. Inner lateral view (29P2056).
4, 7	Paltodus sp. Lateral views (29P2503, 29P2508).
5	Neoprioniodus armata (Hinde). Inner lateral view (29P2016).
6	Synprioniodina sp. Inner lateral view (29P2022).
8-10	Icriodus latericrescens Branson & Mehl. 8, 9, Oral views of incomplete specimens (29P2510, 29P2511); 10a, b, oral and aboral views, respectively, of incomplete specimen (29P2509).
11,12	Icriodus alternatus Branson & Mehl. 11, Oral view (29P2000); 12a, b, aboral and oral views, respectively (29P2049).
13-15	Icriodus symmetricus Branson & Mehl. Oral and aboral views, respectively (29P2506, 29P2500, 29P2012).

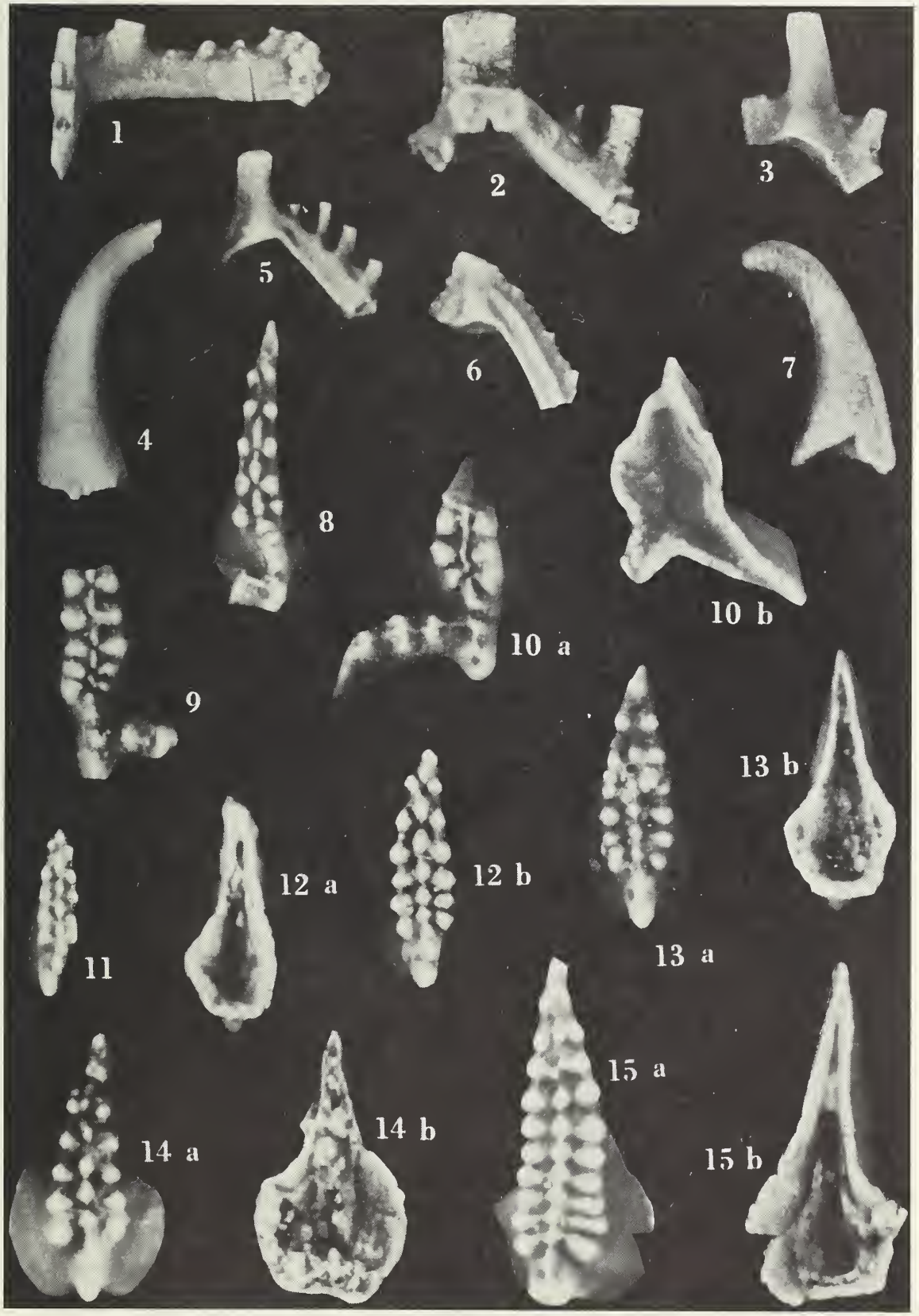


PLATE 2

ORR

BRYANT, 1921, Buffalo Soc. Nat. Sci., Bull., v. 13, no. 2, p. 23, 24, pl. 10, figs. 1-9; HOLMES, 1928, U. S. Natl. Mus. Proc., v. 72, art. 5, p. 18, pl. 7, figs. 10, 12.

Polygnathus pennata Hinde BRANSON & MEHL, 1933b, Missouri Univ. Studies, v. 8, no. 2, p. 144, 145, pl. 11, fig. 3; BECKMANN, 1949, Senckenbergiana, Bd. 30, p. 155, pl. 1, figs. 4, 5, pl. 4, fig. 3; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 94, 95, pl. 17, figs. 14, 16-30, pl. 21, fig. 32; CLOUD, BARNES, & HASS, 1957, Geol. Soc. Am. Bull., v. 68, no. 7, p. 812, pl. 4, fig. 2; HASS, 1959, U. S. Geol. Survey Prof. Paper 294-J, pl. 50, fig. 19.

Description.—The platform is elongate-oval in outline, pointed at the posterior end, and slightly arched in lateral view. The oral surface bears nodes posteriorly, which are enlarged into transverse ribs in the anterior portion. Shallow troughs originate near the posterior end and gradually deepen anteriorly. Aborally, a rather small, oval basal cavity is located near the anterior end of the platform. A sharp keel, increasing in height posteriorly, extends from the basal cavity. A shallow groove that pinches out on the free blade extends anteriorly from the basal cavity. The free blade is long, nearly equal in length to the platform, and is straight to slightly bowed. It consists of approximately 10 to 12 laterally compressed denticles, fused in the lower half, that increase slightly in height anteriorly. In the area of the platform, the blade continues as a median carina composed of strong, fused nodes, decreasing in size posteriorly. Some specimens exhibit discrete nodes toward the posterior end of the platform.

Material studied.—Three specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2052, 29P2053 (figured specimens).

POLYGNATHUS cf. P. PERACUTA Bryant

Pl. 4, figs. 3, 4

Polygnathus peracutus BRYANT, 1921, Buffalo Soc. Nat. Sci., Bull., v. 13, no. 2, p. 25, pl. 10, fig. 12.

Polygnathus peracuta Bryant HUDDLE, 1934, Bull. Am. Paleontology, v. 21, no. 72, p. 97, pl. 8, fig. 8; BISCHOFF & ZIEGLER, 1957, Abh. hess. L.-Amt. Bodenforsch., H. 22, p. 95, pl. 16, fig. 29.

Description.—The platform is narrow, triangular in oral outline, pointed at the posterior end, arched in the lateral view, and bears strong, round nodes. The areas on either side of the carina are nearly flat throughout the entent of the platform, with short, shallow troughs at the anterior end. Aborally, a large, subcircular, deep

EXPLANATION OF PLATE 3

All figures X60

FIGS.	Numbers in parentheses refer to specimen number.
1, 3, 9	Polygnathus n. sp. 1a, b, Inner lateral and oral views, respectively (29P2043); 3a, b, aboral and oral views, respectively (29P2048); 9a, b, aboral and oral views, respectively, of abnormal specimen exhibiting a bifurcating keel (29P2017).
2	Polygnathus decorosa Stauffer. 2a-c, Outer lateral, oral, and aboral views, respectively, of mature specimen (29P2009).
4-8, 10	Polygnathus cristata Hinde. 4, Oral view (29P2001); 5a, b, oral and a boral views, respectively (29P2002); 6a, b, oral and aboral views, respectively (29P2003); 7, 8, oral views of specimens with laterally offset blades (29P2011, 29P2013); 10, oral view of juvenile (29P2026).

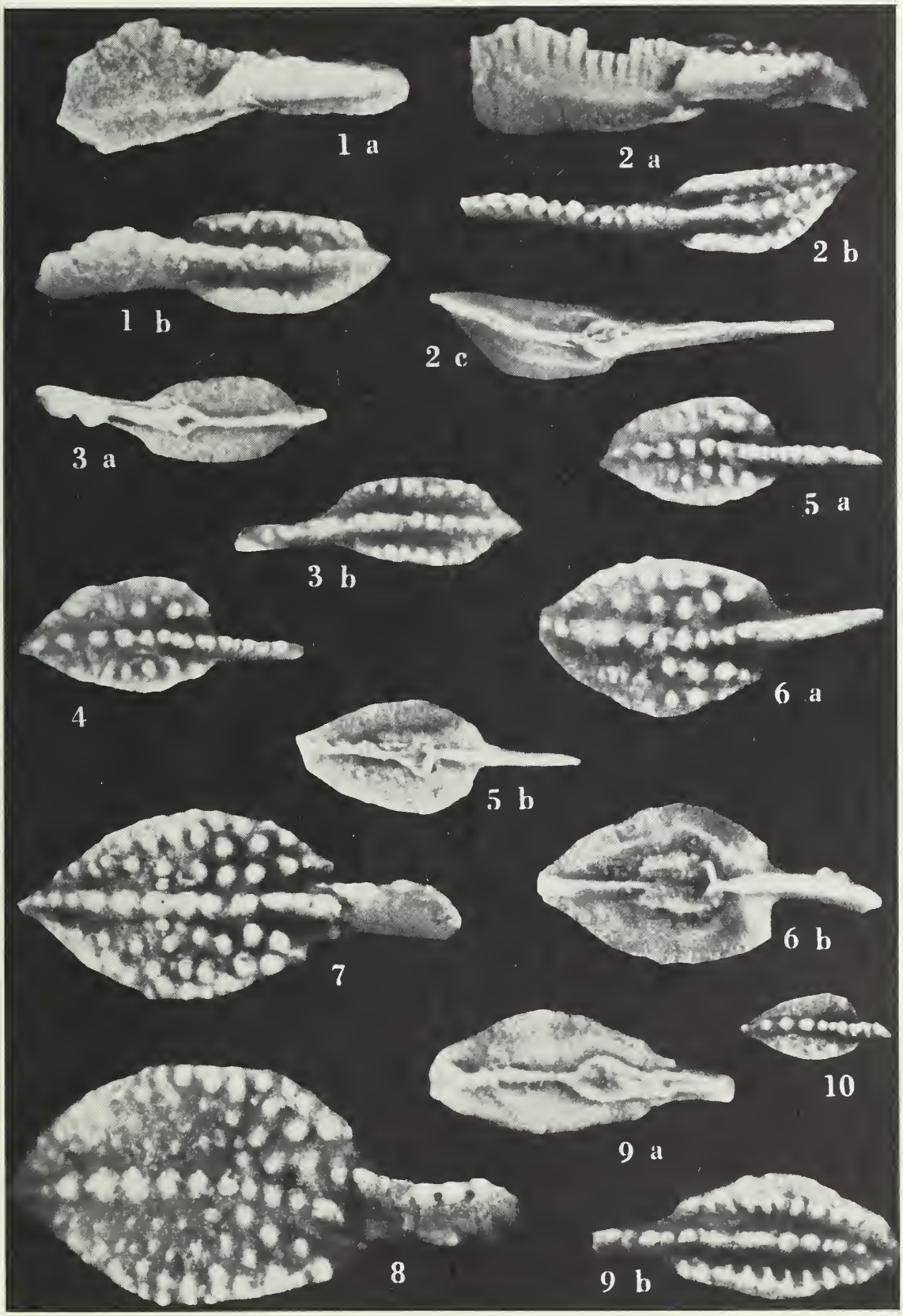


PLATE 3 ORR

basal cavity with flaring edges is located at the anterior end of, or slightly anterior to, the platform. A sharp keel, increasing in height posteriorly, extends from the basal cavity to the posterior end of the platform. The free blade is nearly equal in length to, or somewhat longer than, the platform. It consists of strong, laterally compressed denticles, which are oval in cross section, fused in the lower part, and increase rapidly in height anteriorly. The anterior denticles are significantly larger than those to the rear. In the area of the platform, the blade continues as a row of strong, discrete, round nodes that decrease in size posteriorly.

Material studied.–Three specimens.

Distribution.–Alto Formation.

Repository.–Illinois State Geological Survey, 29P2047, 29P2054 (figured specimens).

POLYGNATHUS n. sp.
Pl. 3, figs. 1, 3, 9; Pl. 4, fig. 1

Description.–The platform is elongate in oral outline, pointed at the posterior end, straight to distinctly bowed, and arched in lateral view. The sides of the platform are nearly perpendicular to the plane of the platform. The edges bear strong, round nodes in rows that are aligned parallel with the carina. Some specimens exhibit narrow, nearly smooth margins outside the rows of nodes. Very deep, unornamented troughs extend the length of the platform. The free blade is short, approximately half the length of the platform, and rapidly increases in height anteriorly. It is composed of 4 to 6 indistinct, laterally compressed, fused denticles that decrease abruptly in height toward the carina. The carina is high, ridgelike, and composed of fused nodes that gradually decrease in height posteriorly. Aborally, a shallow, oval basal cavity with thick rims is located in the posterior third of the platform. A rounded keel extends posteriorly from the basal cavity. It increases in height and thickens markedly at the posterior end of the platform. A distinct groove extends anteriorly from the basal cavity and pinches out on the free blade. Some specimens display distinct growth lines aborally. One specimen exhibits an abnormal bifurcation of the keel at the posterior end of the platform.

Material studied.–17 specimens.

Distribution.–Alto Formation.

Repository.–Illinois State Geological Survey, 29P2043, 29P2048, 29P2017, 29P2032 (figured specimens).

EXPLANATION OF PLATE 4

All figures X60

FIGS.	Numbers in parentheses refer to specimen number.
1	Polygnathus n. sp. 1a-c, Aboral, outer lateral, and oral views, respectively (29P2032).
2	Polygnathus? sp. 2a-c, Oral, outer lateral, and aboral views, respectively (29P2007).
3, 4	Polygnathus cf. P. peracuta Bryant. 3, Oral view of juvenile (29P2047); 4a-c, outer lateral, aboral, and oral views, respectively (29P2054).
5, 6	Polygnathus pennata Hinde. Oral views (29P2052, 29P2053).
7	Polygnathus sp. 7a, b, Aboral and oral views, respectively (29P2014).
8, 9	Polygnathus linguiformis Hinde. Oral views (29P2502, 29P2505).

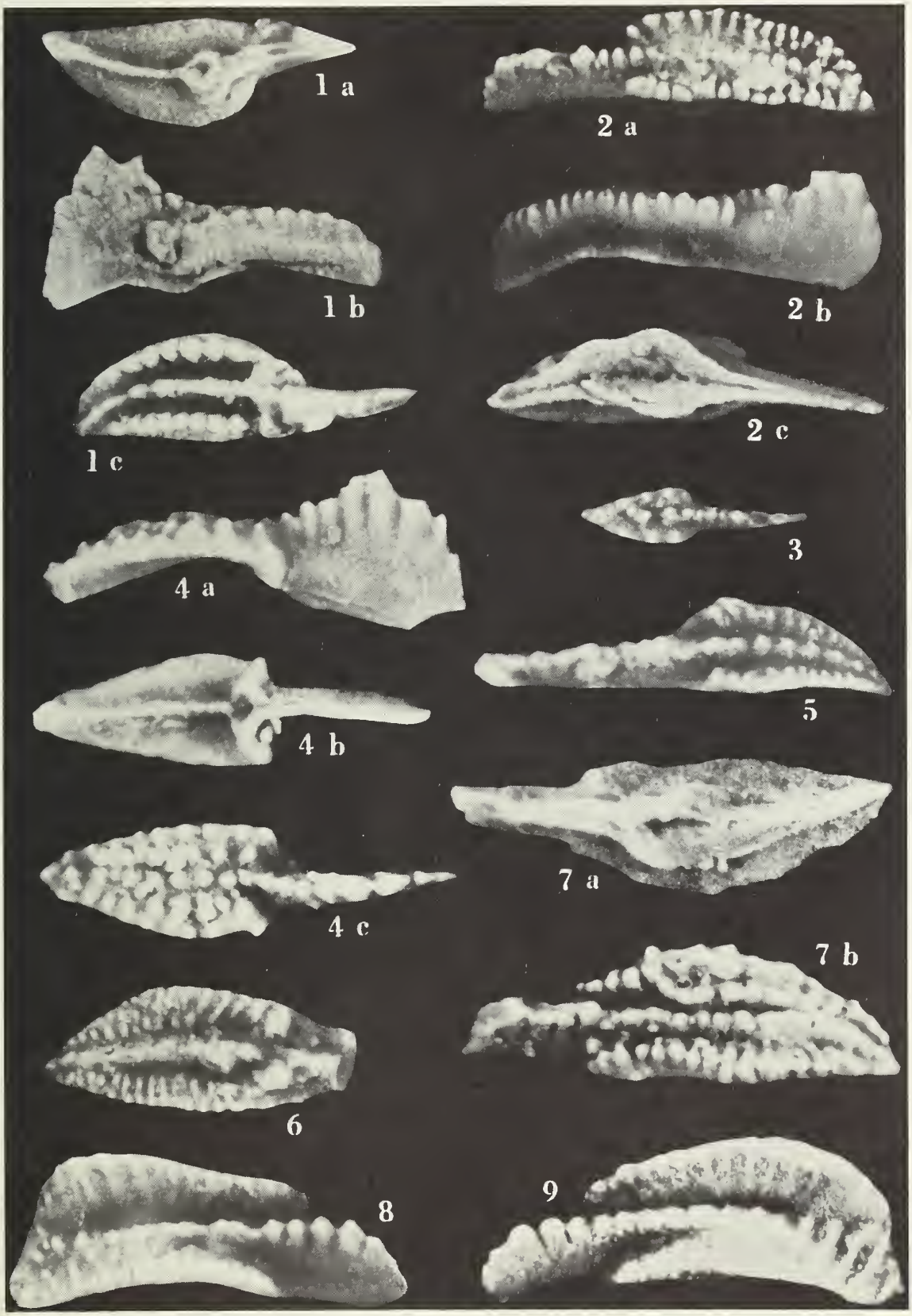


PLATE 4 ORR

POLYGNATHUS sp.
Pl. 4, fig. 7

Description.—The platform is elongate-oval in outline, pointed at the posterior end, and slightly arched in lateral view. The oral surface is nearly flat, curving down at the posterior end. The edges are covered with large nodes, fused at the base, and notched like denticles in the lateral view. A row of strong nodes, round in cross section, parallels the carina throughout on the outer side of the platform. At the anterior end of the platform, the row of nodes diverges away from the carina. The free blade is thick and composed of fused denticles that continue in the area of the platform as a row of strong, fused nodes. A shallow, thick-walled, elongate-oval basal cavity is found on the aboral side of the platform in its anterior half. A strong, rounded keel extends from the basal cavity to the posterior end of the platform. Anteriorly, a narrow groove extends from the basal cavity along the lower edge of the thick, free blade. Secondary keels are low and rounded, extending from the outer edges of the basal cavity to the posterior end of the primary keel.

Material studied.—Two specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2014 (figured specimen).

POLYGNATHUS? sp.
Pl. 4, fig. 2

Description.—The platform is long and narrow, arched in lateral view, and pointed at the posterior end. The edges are strongly denticulate throughout their length. Shallow, unornamented troughs parallel the carina throughout. The platform joins with the free blade slightly above mid-height. Aborally, a huge basal cavity is located beneath the platform. This cavity is deep, widest slightly anterior to the middle of the platform, and continues to the posterior end of the platform as a wide, deep groove with flaring, nearly parallel edges. A wide, deep groove, also with flaring edges, extends anteriorly from the basal cavity and pinches out about mid-length on the free blade. The free blade consists of fused denticles, laterally compressed, increasing in height anteriorly, and inclined slightly posteriorly. In the area of the platform, the free blade continues as a row of round, discrete nodes to the posterior end of the platform. The entire specimen is bowed.

Material studied.—A single specimen.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2007 (figured specimen).

Genus ROUNDYA Hass, 1953
Type species: Roundya barnettana Hass

ROUNDYA spp.
Pl. 2, fig. 2

Remarks.—Several specimens are referable to this genus. Specific identifications are not justifiable due to the fragmentary nature of the material. The figured specimen is a typical example.

Material studied.—Three specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2037 (figured specimen).

Genus SYNPRIONIODINA Bassler, 1925
Type species: Synprioniodina alternata Ulrich & Bassler

SYNPRIONIODINA sp.
Pl. 2, fig. 6

Description.—The bar is either straight or very slightly arched, oval in cross section, and nearly the same width throughout. The underside of the bar bears a wide, shallow groove throughout its length and a deep pit beneath the cusp, the outer margin of which is formed by the downward projection of the latter. Denticles on the bar are closely crowded, subequal in size, and inclined nearly parallel with the cusp, which is wide and laterally compressed. The downward projection bears about six closely spaced denticles, subequal in size, and slightly smaller than those on the bar.

Material studied.—Two specimens.

Distribution.—Alto Formation.

Repository.—Illinois State Geological Survey, 29P2022 (figured specimen).

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